

FILE COPY

10/050,593

Dialog

Set	Items	Description
S1	20167	RHIZOBIA OR RHIZOBIAL
S2	107450	LEGUME OR LEGUMINOUS
S3	5264	S1 AND S2
S4	4	S3 AND HERBICIDE(W)RESISTANT
S5	4	RD S4 (unique items)
S6	4	S5 NOT PY>2001
S7	24	S3 AND (SUPERIOR(N5)NITROGEN(N5) (FIXING OR FIXATION))
S8	7	RD S7 (unique items)
S9	6	S8 NOT PY>2001

6/3/1 (Item 1 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
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03672443 Genuine Article#: PW772 No. References: 46  
Title: INSECTICIDAL ACTIVITY AND COMPETITIVENESS OF RHIZOBIUM SPP  
CONTAINING THE BACILLUS-THURINGIENSIS SUBSP TENEBRIONIS DELTA-ENDOTOXIN  
GENE (CRYIII) IN **LEGUME** NODULES  
Author(s): BEZDICEK DF; QUINN MA; FORSE L; HERON D; KAHN ML  
Corporate Source: WASHINGTON STATE UNIV,DEPT CROP & SOIL  
SCI/PULLMAN//WA/99164; USDA,ANIM & PLANT HLTH INSPECT  
SERV/HYATTSVILLE//MD/20782; WASHINGTON STATE UNIV,INST BIOL CHEM,DEPT  
MICROBIOL/PULLMAN//WA/99164  
Journal: SOIL BIOLOGY & BIOCHEMISTRY, 1994, V26, N12 (DEC), P1637-1646  
ISSN: 0038-0717  
Language: ENGLISH Document Type: ARTICLE (Abstract Available)

6/3/2 (Item 2 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
(c) 2002 Inst for Sci Info. All rts. reserv.

03615806 Genuine Article#: PR206 No. References: 50  
Title: ENOD40, A GENE EXPRESSED DURING NODULE ORGANOGENESIS, CODES FOR A  
NONTRANSLATABLE RNA INVOLVED IN PLANT-GROWTH  
Author(s): CRESPI MD; JURKEVITCH E; POIRET M; DAUBENTONCARAFA Y; PETROVICS  
G; KONDOROSI E; KONDOROSI A  
Corporate Source: CNRS,INST SCI VEGETALES/F-91198 GIF SUR YVETTE//FRANCE/;  
CNRS,INST SCI VEGETALES/F-91198 GIF SUR YVETTE//FRANCE/; CNRS,CTR GENET  
MOLEC/F-91198 GIF SUR YVETTE//FRANCE/; HUNGARIAN ACAD SCI,BIOL RES  
CTR,INST GENET/H-6701 SZEGED//HUNGARY/  
Journal: EMBO JOURNAL, 1994, V13, N21 (NOV 1), P5099-5112  
ISSN: 0261-4189  
Language: ENGLISH Document Type: ARTICLE (Abstract Available)

6/3/3 (Item 3 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
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03503682 Genuine Article#: PH746 No. References: 47  
Title: THE EFFECT OF TOXIN-PRODUCING RHIZOBIUM STRAINS, ON LARVAE OF  
SITONA-FLAVESCENS FEEDING ON **LEGUME** ROOTS AND NODULES  
Author(s): SKOT L; TIMMS E; MYTTON LR  
Corporate Source: AFRC,INST GRASSLAND & ENVIRONM RES,PLAS  
GGERDDAN/ABERYSTWYTH SY23 3EB/DYFED/WALES/  
Journal: PLANT AND SOIL, 1994, V163, N1 (JUN), P141-150  
ISSN: 0032-079X  
Language: ENGLISH Document Type: ARTICLE (Abstract Available)

6/3/4 (Item 1 from file: 357)  
DIALOG(R)File 357:Derwent Biotech Res.  
(c) 2002 Thomson Derwent & ISI. All rts. reserv.

0055319 DBA Accession No.: 86-13167 PATENT  
**Herbicide resistant** Rhizobium production - by repeatedly  
treating with herbicide solution, inoculating leguminosae seeds, sowing  
and isolating  
PATENT ASSIGNEE: Takarmanytermesztes. 1986  
PATENT NUMBER: HU T038598 PATENT DATE: 860630 WPI ACCESSION NO.:  
86-214188 (8633)  
PRIORITY APPLIC. NO.: HU 833617 APPLIC. DATE: 831019  
NATIONAL APPLIC. NO.: HU 833617 APPLIC. DATE: 831019

LANGUAGE: Hungarian

? t s6/k/1-4

>>>KWIC option is not available in file(s): 41, 77, 399

6/K/1 (Item 1 from file: 34)

DIALOG(R)File 34:(c) 2002 Inst for Sci Info. All rts. reserv.

...Title: COMPETITIVENESS OF RHIZOBIUM SPP CONTAINING THE  
BACILLUS-THURINGIENSIS SUBSP TENEBRIONIS DELTA-ENDOTOXIN GENE (CRYIII)  
IN **LEGUME** NODULES  
...Abstract: utilization of a conditional nifH promoter that is involved in  
nitrogen fixation. The cryIII-containing **rhizobia** (i.e.  
Cl-pBtt-LZ and Cl-pBtt-nH) expressed toxin in sufficient quantities  
within...  
...Pisum sativum and Sitona hispidulus on Medicago sativa. The pRK311  
plasmid remained stable in the **rhizobia** that were either  
free-living or within nodules of the legumes. The engineered  
cryIII-containing...  
...Research Fronts: 006 (MICROPROJECTILE BOMBARDMENT; TRANSGENIC RICE  
(ORYZA-SATIVA L) PLANTS; INSECTICIDAL CRYSTAL PROTEIN GENE; STABLY  
TRANSFORMED **HERBICIDE RESISTANT** CALLUS)  
92-4812 001 (PUTATIVE ANAEROBIC COPROPORPHYRINOGEN-III OXIDASE IN  
RHODOBACTER-SPHAEROIDES; TRANSCRIPTIONAL REGULATORY ELEMENT...

6/K/2 (Item 2 from file: 34)

DIALOG(R)File 34:(c) 2002 Inst for Sci Info. All rts. reserv.

...Abstract: inducing root nodules. However, certain Medicago plants can  
form nodules spontaneously, in the absence of **rhizobia**. A  
differential screening was performed using spontaneous nodule versus  
root cDNAs from Medicago sativa ssp...  
...Research Fronts: INDUCIBLE NODULATION GENES; RHIZOBIUM-LEGUMINOSARUM  
BIOVAR VICIAE; PEA ROOT NODULE DEVELOPMENT; AUXIN TRANSPORT; MOLECULAR  
SIGNALS; **LEGUME** SYMBIOSIS)  
92-0805 001 (MICROPROJECTILE BOMBARDMENT; TRANSGENIC RICE (ORYZA-SATIVA  
L) PLANTS; INSECTICIDAL CRYSTAL PROTEIN GENE; STABLY TRANSFORMED  
**HERBICIDE RESISTANT** CALLUS)  
92-4812 001 (PUTATIVE ANAEROBIC COPROPORPHYRINOGEN-III OXIDASE IN  
RHODOBACTER-SPHAEROIDES; TRANSCRIPTIONAL REGULATORY ELEMENT...

6/K/3 (Item 3 from file: 34)

DIALOG(R)File 34:(c) 2002 Inst for Sci Info. All rts. reserv.

Title: THE EFFECT OF TOXIN-PRODUCING RHIZOBIUM STRAINS, ON LARVAE OF  
SITONA-FLAVESCENS FEEDING ON **LEGUME** ROOTS AND NODULES  
Abstract: Larvae of the weevil Sitona spp. specifically eat the root  
nodules formed on **legume** plants by the soil bacterium Rhizobium,  
This can adversely affect the nitrogen fixing activity in the root  
nodules and lead to decreases in yield. Transgenic **rhizobia** were  
used in a novel approach to the biological control of Sitona. Two  
transcriptional fusions...  
...larvae of Sitona flavescens, In both white clover and pea plants  
nodulated by the transgenic **rhizobia** a slightly smaller  
proportion of root nodules were damaged compared to the wild type  
control...  
...Research Fronts: 002 (MICROPROJECTILE BOMBARDMENT; TRANSGENIC RICE  
(ORYZA-SATIVA L) PLANTS; INSECTICIDAL CRYSTAL PROTEIN GENE; STABLY  
TRANSFORMED **HERBICIDE RESISTANT** CALLUS)  
92-4812 002 (PUTATIVE ANAEROBIC COPROPORPHYRINOGEN-III OXIDASE IN  
RHODOBACTER-SPHAEROIDES; TRANSCRIPTIONAL REGULATORY ELEMENT...

...INDUCIBLE NODULATION GENES; RHIZOBIUM-LEGUMINOSARUM BIOVAR VICIAE; PEA  
ROOT NODULE DEVELOPMENT; AUXIN TRANSPORT; MOLECULAR SIGNALS;  
**LEGUME** SYMBIOSIS)  
92-3056 001 (UPTAKE OF SURFACTANT PROTEIN-B; CASEIN KINASE-II;  
CATALYTIC SUBUNITS)  
92...

6/K/4 (Item 1 from file: 357)  
DIALOG(R) File 357:(c) 2002 Thomson Derwent & ISI. All rts. reserv.

**Herbicide resistant Rhizobium production**

ABSTRACT: **Rhizobia** with good herbicide tolerance are prepared by (1) isolating **Rhizobium** varieties from the live root tissue of selected high-nitrogen binding leguminosae, (2) treating the **Rhizobia** with herbicides normally used during the cultivation of leguminosae and other important crops like wheat and maize, (3) inoculating a synthetic mixture of the most important leguminosae with the **Rhizobia** surviving the herbicide treatment and (4) sowing the seeds of the inoculated leguminosae into seed trays containing soil which has never grown soybeans. **Rhizobia** are isolated from the roots of resulting plants. Preferably, the process is repeated 3-4 times with increasing herbicide concentrations. The process is finally scaled up to fields, the resulting **Rhizobia** being mixed with herbicide solutions and applied to the soil.

DESCRIPTORS: Rhizobium generation with improved herbicide resistance, strain improvement, nitrogen-fixation, **legume** bacterium  
pesticide resistance plant

?

9/3/1 (Item 1 from file: 5)  
DIALOG(R)File 5:Biosis Previews(R)  
(c) 2002 BIOSIS. All rts. reserv.

10138901 BIOSIS NO.: 199698593819  
Preference in the nodulation of Phaseolus vulgaris cultivar RAB39.  
AUTHOR: Montealegre C; Graham P H(a); Kipe-Nolt J A  
AUTHOR ADDRESS: (a)Rhizobium Res. Lab., Dep. Soil Water Climate, Univ.  
Minnesota, St. Paul, MN 55108\*\*USA  
JOURNAL: Canadian Journal of Microbiology 41 (11):p992-998 1995  
ISSN: 0008-4166  
DOCUMENT TYPE: Article  
RECORD TYPE: Abstract  
LANGUAGE: English

9/3/2 (Item 2 from file: 5)  
DIALOG(R)File 5:Biosis Previews(R)  
(c) 2002 BIOSIS. All rts. reserv.

10007328 BIOSIS NO.: 199598462246  
Manipulation of **rhizobia** microflora for improving **legume**  
productivity and soil fertility: A critical assessment.  
AUTHOR: Brockwell John(a); Bottomley Peter J; Thies Janice E  
AUTHOR ADDRESS: (a)CSIRO Div. Plant Ind., GPO Box 1600, Canberra, ACT 2601  
\*\*Australia  
JOURNAL: Plant and Soil 174 (1-2):p143-180 1995  
ISSN: 0032-079X  
DOCUMENT TYPE: Article  
RECORD TYPE: Abstract  
LANGUAGE: English

9/3/3 (Item 3 from file: 5)  
DIALOG(R)File 5:Biosis Previews(R)  
(c) 2002 BIOSIS. All rts. reserv.

08265406 BIOSIS NO.: 000094046579  
POTENTIAL FOR INCREASING NITROGEN FIXATION IN GRAIN LEGUMES  
AUTHOR: BUTTERY B R; PARK S J; HUME D J  
AUTHOR ADDRESS: AGRIC. CANADA RES. STATION, HARROW, ONT. N0R 1G0, CAN.  
JOURNAL: CAN J PLANT SCI 72 (2). 1992. 323-349. 1992  
FULL JOURNAL NAME: Canadian Journal of Plant Science  
CODEN: CPLSA  
DOCUMENT TYPE: Review  
RECORD TYPE: Abstract  
LANGUAGE: ENGLISH

9/3/4 (Item 1 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
(c) 2002 Inst for Sci Info. All rts. reserv.

01974535 Genuine Article#: JQ929 No. References: 238  
Title: GENETICS OF COMPETITION FOR NODULATION OF LEGUMES  
Author(s): TRIPLETT EW; SADOWSKY MJ  
Corporate Source: UNIV WISCONSIN, DEPT AGRON/MADISON//WI/53706; UNIV  
WISCONSIN, CTR STUDY NITROGEN FIXAT/MADISON//WI/53706; UNIV  
MINNESOTA, DEPT SOIL SCI/ST PAUL//MN/55108; UNIV MINNESOTA, DEPT  
MICROBIOL/ST PAUL//MN/55108  
Journal: ANNUAL REVIEW OF MICROBIOLOGY, 1992, V46, P399-428  
ISSN: 0066-4227  
Language: ENGLISH Document Type: REVIEW (Abstract Available)

9/3/5 (Item 1 from file: 76)  
DIALOG(R)File 76:Life Sciences Collection  
(c) 2002 Cambridge Sci Abs. All rts. reserv.

00644692 0460822

Field evaluation of selected Rhizobium in an improved legume  
inoculant.

Kremer, R.J.; Peterson, H.L.

Dep. Agron., Univ. Missouri, Columbia, MO 65201, USA

AGRON. J. vol. 75, no. 1, pp. 139-143 (1983.)

DOCUMENT TYPE: Journal article LANGUAGE: ENGLISH

SUBFILE: Microbiology Abstracts Section B: Bacteriology; Microbiology  
Abstracts Section A: Industrial and Applied Microbiology

9/3/6 (Item 1 from file: 98)  
DIALOG(R)File 98:General Sci Abs/Full-Text  
(c) 2002 The HW Wilson Co. All rts. reserv.

03790963 H.W. WILSON RECORD NUMBER: BGS198040963 (USE FORMAT 7 FOR  
FULLTEXT)

Legumes may be symbiont-limited during old-field succession.

Larson, Jennifer L

Siemann, Evan

The American Midland Naturalist (Am Midl Nat) v. 140 no1 (July '98) p. 90-5

SPECIAL FEATURES: bibl il ISSN: 0003-0031

LANGUAGE: English

COUNTRY OF PUBLICATION: United States

WORD COUNT: 2057

?

9/3/1 (Item 1 from file: 5)  
DIALOG(R)File 5:Biosis Previews(R)  
(c) 2002 BIOSIS. All rts. reserv.

10138901 BIOSIS NO.: 199698593819  
Preference in the nodulation of Phaseolus vulgaris cultivar RAB39.  
AUTHOR: Montealegre C; Graham P H(a); Kipe-Nolt J A  
AUTHOR ADDRESS: (a)Rhizobium Res. Lab., Dep. Soil Water Climate, Univ.  
Minnesota, St. Paul, MN 55108\*\*USA  
JOURNAL: Canadian Journal of Microbiology 41 (11):p992-998 1995  
ISSN: 0008-4166  
DOCUMENT TYPE: Article  
RECORD TYPE: Abstract  
LANGUAGE: English

9/3/2 (Item 2 from file: 5)  
DIALOG(R)File 5:Biosis Previews(R)  
(c) 2002 BIOSIS. All rts. reserv.

10007328 BIOSIS NO.: 199598462246  
Manipulation of rhizobia microflora for improving legume  
productivity and soil fertility: A critical assessment.  
AUTHOR: Brockwell John(a); Bottomley Peter J; Thies Janice E  
AUTHOR ADDRESS: (a)CSIRO Div. Plant Ind., GPO Box 1600, Canberra, ACT 2601  
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JOURNAL: Plant and Soil 174 (1-2):p143-180 1995  
ISSN: 0032-079X  
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RECORD TYPE: Abstract  
LANGUAGE: English

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(c) 2002 BIOSIS. All rts. reserv.

08265406 BIOSIS NO.: 000094046579  
POTENTIAL FOR INCREASING NITROGEN FIXATION IN GRAIN LEGUMES  
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AUTHOR ADDRESS: AGRIC. CANADA RES. STATION, HARROW, ONT. NOR 1G0, CAN.  
JOURNAL: CAN J PLANT SCI 72 (2). 1992. 323-349. 1992  
FULL JOURNAL NAME: Canadian Journal of Plant Science  
CODEN: CPLSA  
DOCUMENT TYPE: Review  
RECORD TYPE: Abstract  
LANGUAGE: ENGLISH

9/3/4 (Item 1 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
(c) 2002 Inst for Sci Info. All rts. reserv.

01974535 Genuine Article#: JQ9220 No. References: 238  
Title: GENETICS OF COMPETITION FOR NODULATION OF LEGUMES  
Author(s): TRIPLETT EW; SADOWSKY MJ  
Corporate Source: UNIV WISCONSIN, DEPT AGRON/MADISON//WI/53706; UNIV  
WISCONSIN, CTR STUDY NITROGEN FIXAT/MADISON//WI/53706; UNIV  
MINNESOTA, DEPT SOIL SCI/ST PAUL//MN/55108; UNIV MINNESOTA, DEPT  
MICROBIOL/ST PAUL//MN/55108  
Journal: ANNUAL REVIEW OF MICROBIOLOGY, 1992, V46, P399-428  
ISSN: 0066-4227  
Language: ENGLISH Document Type: REVIEW (Abstract Available)



9/3/5 (Item 1 from file: 76)  
DIALOG(R)File 76:Life Sciences Collection  
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00644692 0460822

Field evaluation of selected Rhizobium in an improved **legume**  
inoculant.

Kremer, R.J.; Peterson, H.L.

Dep. Agron., Univ. Missouri, Columbia, MO 65201, USA

AGRON. J. vol. 75, no. 1, pp. 139-143 (1983.)

DOCUMENT TYPE: Journal article LANGUAGE: ENGLISH

SUBFILE: Microbiology Abstracts Section B: Bacteriology; Microbiology  
Abstracts Section A: Industrial and Applied Microbiology

9/3/6 (Item 1 from file: 98)  
DIALOG(R)File 98:General Sci Abs/Full-Text  
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03790963 H.W. WILSON RECORD NUMBER: BGS198040963 (USE FORMAT 7 FOR  
FULLTEXT)

Legumes may be symbiont-limited during old-field succession.

Larson, Jennifer L

Siemann, Evan

The American Midland Naturalist (Am Midl Nat) v. 140 no1 (July '98) p. 90-5

SPECIAL FEATURES: bibl il ISSN: 0003-0031

LANGUAGE: English

COUNTRY OF PUBLICATION: United States

WORD COUNT: 2057

? t s9/k/1-6

>>>KWIC option is not available in file(s): 41, 77, 399

9/K/1 (Item 1 from file: 5)  
DIALOG(R)File 5:(c) 2002 BIOSIS. All rts. reserv.

ABSTRACT: The low nodule occupancy achieved by **superior**  
**nitrogen-fixing** inoculant strains is a problem in the  
production of many traditional **legume** species. including Phaseolus  
vulgaris. Cultivars that select for inoculant strains, rather than  
nodulate with ineffective indigenous **rhizobia**, offer one approach  
to the resolution of this problem. In this study we identify a...

9/K/2 (Item 2 from file: 5)  
DIALOG(R)File 5:(c) 2002 BIOSIS. All rts. reserv.

Manipulation of **rhizobia** microflora for improving **legume**  
productivity and soil fertility: A critical assessment.

...ABSTRACT: augmented as the world's population increases and as the  
natural resources that supply fertilizer **nitrogen** diminish. This  
objective will be achieved through the development of **superior**  
**legume** varieties, improvement in agronomic practice, and increased  
efficiency of the **nitrogen fixation** process itself by better  
management of the symbiotic relationship between plant and bacteria. This  
paper...

...nodule bacteria, established and introduced, can be manipulated  
ecologically, agronomically, edaphically and genetically to improve  
**legume** productivity and, as a consequence, soil fertility.

MISCELLANEOUS TERMS: ...**LEGUMINOUS TREES**...

...RHIZOBIAL ECOLOGY...

...RHIZOBIAL GENETICS

9/K/3 (Item 3 from file: 5)  
DIALOG(R)File 5:(c) 2002 BIOSIS. All rts. reserv.

...ABSTRACT: review considers the main factors determining the level of nitrogen fixation in the major grain-legume crops (chickpea, common bean, cowpea, faba bean, lentil, pea, peanut, pigeon pea and soybean) and ...

...various crops to both the addition of nitrogen fertilizer and inoculation with effective strains of **rhizobia** are discussed. The present situation and future prospects for increasing **nitrogen fixation** through plant breeding, development of **superior** strains, **superior** host-strain combinations, improved inoculation techniques, bioengineering and other non-traditional methods are discussed. The...

9/K/4 (Item 1 from file: 34)  
DIALOG(R)File 34:(c) 2002 Inst for Sci Info. All rts. reserv.

Abstract: An economically important problem in microbial ecology concerns the efficacy of **rhizobial** inoculants for the formation of nitrogen-fixing root nodules on **legume** crop plants such as soybean, alfalfa, and clover. Some strains of **rhizobia** can increase symbiotic nitrogen fixation under controlled conditions. However, attempts to improve nitrogen fixation under...

...conditions with such strains often fail, usually as a result of the presence of indigenous **rhizobia** limiting nodulation by the inoculum strains. This problem is referred to as the Rhizobium competition...

...is being used to address the problem from two perspectives. First, the host specificity of **rhizobia** is being characterized with the long term goal of developing strains that can nodulate a very strain-specific host-legume genotype. Second, the genetic basis of competitiveness in several strains is being examined. Genetic determinants...

...nodulation competitiveness have been isolated and mechanisms for their stable integration into the genome of **superior nitrogen-fixing** strains have been developed. Several phenotypes have been identified as playing an important role in...

9/K/5 (Item 1 from file: 76)  
DIALOG(R)File 76:(c) 2002 Cambridge Sci Abs. All rts. reserv.

Field evaluation of selected Rhizobium in an improved **legume** inoculant.

Increased grain **legume** production depends on effective symbiotic di-nitrogen fixation through successful **legume** inoculation. Inoculants containing high numbers ( greater than or equal to 10 super(7)/g) of...

...must withstand adverse field conditions. Field studies were performed to determine the effects of selected **rhizobia** in two different inoculant carriers on nodulation and performance of three grain legumes. The

experiments...

...of effective *Rhizobium* at planting. Through subsequent effective nodulation, oil-base inoculants increased yields and **nitrogen fixation** by the legumes due to increased nodulation by the **superior** N sub(2)-fixing strains of *Rhizobium*).

9/K/6 (Item 1 from file: 98)  
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(USE FORMAT 7 FOR FULLTEXT)

...ABSTRACT: be rare throughout secondary succession in nitrogen-poor grasslands due to a lack of suitable **rhizobia** and consequently lower growth rates. Reprinted by permission of the publisher.

TEXT:

... soil nitrogen concentration increases (Gorham et al., 1979; Inouye et al., 1987). At low soil **nitrogen** concentrations, **nitrogen-fixing** legumes can be competitively **superior** to nonlegumes. However, studies at Cedar Creek have found that legumes are always rare and ...

...effect. They may also be at a competitive disadvantage due to a lack of compatible **rhizobia** that limit the formation of nodules.

**Rhizobia** differ in their ability to infect different species of plants (Bergey et al., 1984; Paul...

...abandonment of a field previously planted with soybeans, there may initially be an abundance of **rhizobia**. Through time, the numbers of these **rhizobia** may decline if their corresponding symbiont is not present (Paul and Clark, 1989; Kucey and...

...the ability of soybeans to form nodules will decrease with time since last cultivation. Because **rhizobia** for native legumes may come from accumulation of **rhizobia** in the plant-root environment of colonizing legumes (Weaver et al., 1971), we hypothesized that the number of nodules on roots of native prairie **legume** seedlings may increase with time since abandonment. In order to estimate the nodulation potential of...

...successional ages, we used a bioassay employing *Lespedeza capitata* (bush clover, a common native prairie **legume** at Cedar Creek) seeds and soybean seeds.

#### MATERIALS AND METHODS

This work was performed with...

...Because legumes were rare in these fields, this eliminated the bias from sampling at a **legume** but may have biased our **rhizobia** abundance estimates to be slightly too low.

Before planting, the *Lespedeza* and soybean seeds were surface sterilized to reduce **rhizobia** numbers from the seed surface, and scarified to increase the germination of the seeds using...

...3 .

#### DISCUSSION

We used nodule number as an indicator of the relative abundance of compatible **rhizobia** in the soil through succession. The number of nodules per soybean plant decreased significantly with...

...younger fields, especially those previously planted with soybeans, one

might expect a greater number of **rhizobia** compatible with soybean seedlings (*Bradyrhizobium japonicum*, Bergey et al., 1984) than ...with soybeans. Our regression results suggest that only half as many of these soybean compatible **rhizobia** are left in the soil after 30-40 yr.

The opposite might be expected with *Lespedeza*, which are incompatible with soybean **rhizobia** (Bergey et al., 1984); older fields would have more **rhizobia** compatible with *Lespedeza* (a promiscuous *Bradyrhizobium* species, Bergey et al., 1984) due to their accumulation in the soil over time with the continued presence of the corresponding **legume(s)**. We found a low number of nodules on plants grown in soil from young...  
...numbers in soils from older fields suggest that older fields may be poor environments for **rhizobia** or nodulation.

Controlling for the relationship between number of nodules and *Lespedeza* plant size, *Lespedeza*...

...Putten et al., 1993). These factors, together with the low abundances of compatible and effective **rhizobia** in early succession, may limit the rate of succession on nutrient-poor soils by limiting...

...poor soil. *Ecology*, 76:2648-2655.

SOMASEGARAN, P. AND H. J. HOBEN. 1994. Handbook for **rhizobia**: methods in **legume** and rhizobium technology. Springer-Verlag, New York. 450 p.

TILMAN, D. 1982. Resource competition and...

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